HPC4U

Scope

Imagine a weather forecast service that needs to provide several updated forecasts on a daily basis to be used by anyone from families planning trips to air traffic controllers directing commercial aircraft. The weather centre may well use a state-of-the-art high performance computing facility to run complex high resolution models using input data from sources as diverse as aircraft, balloons, satellites and ground observations. In order to be able guarantee that a result is available on time, the analysis may be run in parallel in two separate computing environments in case a fault (such as a machine failing) should occur during. This not only complicates an already complicated task, but it is also inefficient and costly. However thanks to new technology developed by an EU-funded project Hpc4u, such a weather forecast in future could be run on one computing environment with a guarantee of a timely result.

Advances

Hpc4u developed innovative mechanisms to alleviate such business challenges. The project's integrated solution incorporates features such as fault tolerant operation, dynamic application relocation as well as a sophisticated resource management system. The software package implements fault tolerant capabilities for networking, message passing hardware and software, storage subsystems and servers.

Any organisation or enterprise with business critical projects that depend on computational resources but that also need to guarantee they can meet tight deadlines will benefit from a Hpc4u based solution.

Positioning in global context

The Hpc4u project is the first to yield a reliable, predictable, SLA-aware Grid middleware through innovative software technology. Innovation leads to key benefits for users, including:

Resilience: Hpc4u's technology offers this assurance for a critical project, whether commercial or for research, that a job will finish as expected regardless of system failures in the IT infrastructure.

Affordability: The Hpc4u software base blends the flexibility and cost advantage of Open Source Software components with that of enterprise features provided in fully supported commercial components.

Modularity: Components are built as modular units rather than one monolithic code base. This means that users can integrate only the features needed without affecting operation of the software.

Transparent usage: The Hpc4u features are implemented in a **transparent manner for applications**, enabling them to benefit from Hpc4u features without the need to write specific code or recompile the software.

Contribution to standardization and interoperability issues

Standards compliant: In the Hpc4u framework users can integrate any check-pointing mechanisms, storage and networking modules. The top layer API interfaces are OGSA-compliant ('Open Grid Service Architecture') for Grid middleware software. To ensure this compatibility, the Hpc4u partners are working in the related standardization bodies.

Target users / sectors in business and society

Hpc4u, addresses those market segments with requirements to protect and optimize the usage of the Grid infrastructure for critical computational jobs such as industrial organizations which use computation for **product design** (Aerospace, Pharmaceutical, Biotechnologies, Automotive…) and other market segments who using computational power for **decision making** (Finance, Insurance, Weather forecasting…).

Overall benefits for business and society

Hpc4u can provide user organisations with a **better ROI** (Return On Investment) for their computational resources. Moreover, improved reliability and availability of IT resources paves the way for **shortened time to market** particularly for companies using computational jobs in the product development process.

Examples of use

The Swedish Meteorological and Hydrological Institute (SMHI) runs daily weather forecasts using the Hirlam (High Resolution Limited Area Model) forecast model. The main forecast runs every 6 hours and **time window** to ensure the result of the forecast is about one hour. The input data comes from several sources including: aircraft, balloon, satellite and ground observations.

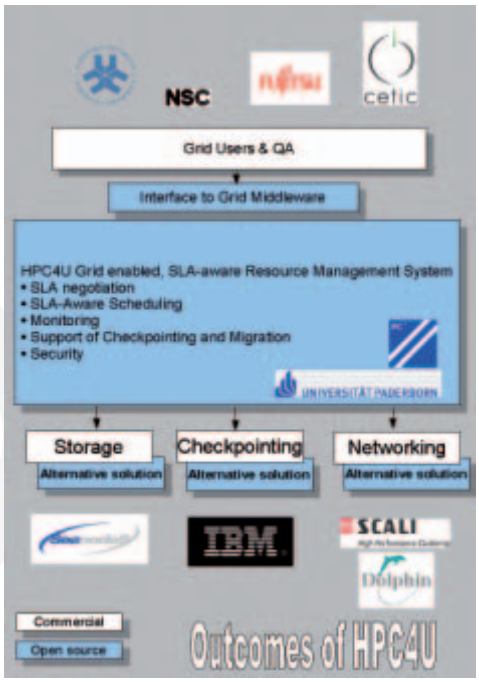
To guarantee that a result is available on time, the weather forecast is run in parallel on two separate computers, one onsite and one offsite.

With Hpc4u, the weather forecast will now only be run once. A timely **result will be guaranteed** due to the combination of software features such as check pointing and migration with alternative hardware resources.

Achievements

Gridtrust is developing an innovative Gridtrust After more than three years of research the Hpc4u project has successfully completed implementation and testing of the "Highly Predictable Cluster". This has resulted in an integrated solution that supports single node and multiple nodes jobs with fault tolerant components as well as SLA awareness.
This realized three distinct solutions:

First solution: The Hpc4u Grid middleware is based on the **SLA-aware resource management system**, and interfaces to the virtualization of the computational nodes with networking and storage. The solution is available using GNU Lesser General Public License.
Thus, the Hpc4u middleware can also be used in commercial products without forcing open source status of these products. In this framework the users can integrate any checkpointing mechanisms, storage and networking modules. On the top layer interfaces for interaction with OGSA-compliant Grid middleware is provided.
The purpose of this first solution is to provide a vehicle for continuing the innovation in the domain of SLA-enabled Grids. Particularly, OpenCCs, a cornerstone component of Hpc4u is also at the core of the Assessgrid project (see http://www.assessgrid.eu/ for details).
Although not commercialized, OpenCCS can be obtained on https://www.openccs.eu/.
Second solution: A vertically **integrated and ready-to-use Hpc4u middleware package**, which contains all necessary fault-tolerance mechanisms and leverages commercial components of several Hpc4u project partners such as check-pointing feature, storage, and networking. This solution is available upon agreement with the relevant partners via commercial licenses and demonstrates the functionality and the performance of Hpc4u technologies for demanding real-world scenarios. Contact: contact@hpc4u.eu.
Third solution: A non-commercial Open Source **Hpc4u Freeware stack** is available for **evaluating and demonstrating** the benefits of the Hpc4u software capabilities. This freeware version of Hpc4u system is based on coLinux (abbreviation of cooperative linux). coLinux is open source and allows to run a Linux kernel as service under Microsoft Windows. This system does not need to be installed, but can be started directly from CD. This minimizes the impact on the customer's machine, making it easier to testdrive the Hpc4u system. This coLinux based system uses OpenCCS and two free and open source components offering basic fault tolerance mechanisms for parallel applications. These components are respectively BLCR (Berkeley Lab Checkpoint/Restart) and LAM-MPI .



HPC4U
Reliable clusters for Grid

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contact point
Gery Schneider
COMPAGNIE IBM FRANCE, FR
E-mail: gery.schneider@fr.ibm.com

project website and partner list
http://www.hpc4u.eu

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42